NOV 12 1982
611 R-1
I49.89:81/08
COMPLETED
26
ORIGINAL

Biological Services Program

FWS/OBS-81/08
JUNE 1981

UTILIZATION OF SURFACE MINE PONDS IN EAST TENNESSEE BY BREEDING AMPHIBIANS

Fish and Wildlife Service

U.S. Department of the Interior

The Biological Services Program was established within the U.S. Fish and Wildlife Service to supply scientific information and methodologies on key environmental issues that impact fish and wildlife resources and their supporting ecosystems.

Projects have been initiated in the following areas: coal extraction and conversion; power plants; mineral development; water resource analysis, including stream alterations and western water allocation; coastal ecosystems and Outer Continental Shelf development; environmental contaminants; National Wetland Inventory; habitat classification and evaluation; inventory and data management systems; and information management.

The Biological Services Program consists of the Office of Biological Services in Washington, D.C., which is responsible for overall planning and management; National Teams, which provide the Program's central scientific and technical expertise and arrange for development of information and technology by contracting with States, universities, consulting firms, and others; Regional Teams, which provide local expertise and are an important link between the National Teams and the problems at the operating level; and staff at certain Fish and Wildlife Service research facilities, who conduct inhouse research studies.

March 3 1849

United States Department of the Interior
FISH AND WILDLIFE SERVICE
EASTERN ENERGY AND LAND USE TEAM
Route 3, Box 44
Kearneysville, West Virginia 25430

October 27, 1982

Dear Colleague:

The Eastern Energy and Land Use Team is pleased to provide you with a copy of "Utilization of Surface Mine Lands in East Tennessee by Breeding Amphibians" (FWS/OBS-82/08). This publication presents results of coal surface mine reclamation monitoring activities carried out by the Tennessee Valley Authority which are closely related to work conducted cooperatively with the U.S. Fish and Wildlife Service.

The biological importance of surface mine ponds and their use by breeding amphibians is discussed in this report. Reclamation specialists, as well as others involved in surface mining, can use this report as a reference document for reclamation planning.

Sincerely,

Edgar A. Pash

Edgar A. Pash
Team Leader
EELUT

Enclosure

FWS/OBS-81/08
June 1981

UTILIZATION OF SURFACE MINE PONDS IN EAST TENNESSEE BY BREEDING AMPHIBIANS

by

Linda J. Turner and Dale K. Fowler

Office of Natural Resources
Division of Land and Forest Resources
Tennessee Valley Authority
Norris, Tennessee 37828

Contract No. 14-16-0009-78-708

Lawrence J. Slaski, Project Officer
Eastern Energy and Land Use Team
Route 3, Box 44
Kearneysville, West Virginia 25430

Ronnie J. Haynes, Project Inspector
U.S. Fish and Wildlife Service
Atlanta, Georgia 30303

Performed for
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior

II

ABSTRACT

Of 24 ponds examined on Ollis Creek Surface Mine, Campbell County, Tennessee, 21 contained breeding amphibians. Twelve species of amphibians were indentified in ponds that ranged from 4.0 to 8.0 in pH. Although ponds with low pH values were used by breeding amphibians, significantly more amphibian species were found in ponds with higher pH values. The average pH of ponds occupied by each amphibian species varied. Spring peepers (*Hyla crucifer*) occupied ponds with the lowest average pH (5.22) while upland chorus frogs (*Pseudacris triseriata feriarum*) utilized ponds with the highest average pH (6.33).

Findings indicated high biological productivity in surface mine ponds. Aquatic vegetation was present in 20 of the 24 ponds. Aquatic insects and a diverse wildlife fauna utilized the study ponds. Large mammals (3 species), waterbirds (17 species), and snakes (2 species) were among those species observed.

Surface mine ponds were found to supply an important habitat component for a variety of wildlife species and therefore improve the quality of wildlife habitat on the surface mines. In some areas, mine ponds are the only source of surface water available for wildlife use.

TABLE OF CONTENTS

Page

Introduction 1

Methods 2

- Study Area 2
- Water Quality 2
- Aquatic Vegetation 2
- Amphibian Inventory 2
- Other Wildlife Observations 2
- Analysis of Data 2

Results and Discussion 2

- Water Quality 2
- Aquatic Vegetation 2
- Amphibian Inventory 5
- Species Accounts 5
  - Hylidae 5
  - Bufonidae 7
  - Ranidae 7
  - Ambystomatidae 8
  - Salamandridae 8
- General Wildlife Observations 8

Implications of Findings 9
Summary 12
Literature Cited 12

LIST OF TABLES

Table Page

1 Water quality measurements and breeding amphibians in Ollis Creek Surface Mine ponds in 1978 4

2 Submergent (S) and emergent (E) vegetation collected in Ollis Creek Surface Mine ponds 5

3 Average of pH of ponds utilized by breeding amphibians on the Ollis Creek site 6

4 Average number of amphibian species occurring in ponds of different pH values on Ollis Creek Surface Mine, March-July, 1978 6

5 Water birds observed on ponds of the Ollis Creek site, Campbell County, Tennessee 10

LIST OF FIGURES

Figure Page

1 This diagram depicts the location of the 24 Ollis Creek Surface Mine ponds which were surveyed for the presence of breeding amphibians 3

2 Adult gray treefrogs used nine of the study ponds, predominantly those with thick stands of aquatic vegetation or closely adjacent to woodland areas 7

3 American toads were frequently observed feeding along the moist weedy edges of the surface mine ponds where insects were plentiful. Breeding, calling, and egg laying took place in July 7

4 Green frogs, which were collected in eight of the Ollis Creek ponds, overwintered as tadpoles in the ponds 8

5 The pickerel frog was the second most widespread amphibian on the Ollis Creek site, occurring in 11 of the 24 ponds 8

6 Spotted salamander eggs were found in eight of the surface mine ponds in early spring. It is not surprising that no adult salamanders were found, since they leave the ponds immediately after laying their eggs 9

7 Large numbers of adult red-spotted newts were found in eight of the study ponds. Gravid females, as well as mating pairs, provided some evidence of breeding success 9

8 Sediment ponds, such as this seven-year-old pond on the Ollis Creek Mine, rapidly develop into attractive wildlife habitat. If permanently retained, such impoundments will have a tremendous positive impact on wildlife in the region 11

9 Surface mine ponds can provide recreational opportunities while improving wildlife habitat. Many abandoned mine ponds, such as this eight-year-old Ollis Creek pond can be successfully stocked with fish 11

INTRODUCTION

Stream siltation from coal surface mines is routinely reduced by constructing sediment basins on and below the disturbed areas. Although the majority of these sediment ponds were retained prior to the passage of the Federal Surface Mining Control and Reclamation Act, since its passage, in general, sediment ponds have been removed, even though their retention may be allowed if compatible with an approved postmining land use.

Permanent bodies of water are compatible with many postmining land uses, including a forest-wildlife management option and in some areas, sediment ponds provide the only source of surface water available for wildlife. As pointed out by Ripley (1969), a source of water is a necessary component of any wildlife management plan. Unfortunately, there is little information available concerning the biological importance of sediment ponds. In the mountainous portion of the the Appalachian coalfield, they are generally thought to have little value to fish and wildlife because of their acidity and small size (less than one acre). However, the few studies which have been conducted indicate that these water sources are utilized by various species of wildlife. For example, Arata (1959) reported use of strip mine ponds in Illinois by muskrat (*Ondatra zibethica*); Smith and Hill (1978) documented the use of strip mine ponds in Alabama by migrating waterfowl. Although several studies include general observations of amphibians on strip mine areas (Riley 1960, Myers and Klimstra 1963), no studies specifically designed to inventory the amphibian fauna associated with surface mine ponds are available. This information is needed because amphibians are an important food source for avian, reptilian, and mammalian predators and are also good biological indicators of pond productivity. The presence of breeding amphibians in surface mine sediment ponds contributes to a strong ecological justification for leaving such ponds as permanent water sources. Consequently, this survey was designed to examine the biological importance of surface mine ponds in one portion of the Appalachian coalfield by (1) inventorying the amphibian fauna occurring in the ponds, (2) measuring selected water quality parameters, (3) collecting and identifying aquatic vegetation, and (4) observing general wildlife use of the surface mine pond habitat.

METHODS

Study Area

The Ollis Creek Surface Mine, located approximately eight km (5 miles) north of Caryville and just east of Interstate 75 in Campbell County, Tennessee, was selected for study. This mine is approximately 550 meters (1800 feet) above sea level and is located near the eastern edge of the Cumberland Plateau within the mixed mesophytic forest of the eastern deciduous forest region (Braun 1950).

Mining operations were terminated in 1972 after approximately 49 ha (120 acres) of the Ollis Creek Mine had been disturbed. Reclamation measures were then implemented to comply with 1972 Tennessee and TVA contract provisions. Approximately 35 silt ponds were formed on the mine bench during reclamation grading, and 24 of these were selected for study (Figure 1). Each pond was visited a minimum of six times from March 20 to July 13, 1978, and examined for the presence of amphibians.

Water Quality

A Hach kit was used to measure pH, alkalinity, and water hardness at three different locations within each pond. These measurements were then averaged to yield a mean value for each parameter by pond. Maximum water depth (to the nearest 0.5 m) was determined by lowering a weighted cord from a small boat to the bottom of each pond.

Aquatic Vegetation

Samples of aquatic vegetation were collected from each pond and identified according to Radford et al. (1968) and Tarver et al. (1978). The value of this aquatic vegetation to wildlife was determined by consulting selected reference material (McAtee 1939, Martin et al. 1961). No attempt was made to estimate densities or biomass of individual plant species.

Amphibian Inventory

Amphibians were collected with a long-handled dip net and were preserved in 10-percent Formalin. Tadpoles were identified using keys by Orton (1952) and Altig (1970); adult amphibians were identified from Conant (1975).

Other Wildlife Observations

During the amphibian survey, general observations of pond use by other wildlife species were recorded to assess the overall use of such habitat by wildlife.

Analysis of Data

A student's t-test $P<0.05$ (Steel and Torrie 1960) was used to test the null hypothesis that there was no significant difference in the average number of amphibian species occurring in surface mine ponds of different pH values.

RESULTS AND DISCUSSION

Water Quality

Study ponds ranged from 4.0 to 8.0 in pH with 58 percent of the ponds having pH values of 4.5 or less. Nine ponds (42 percent) had pH values of 5.5 or greater. Pond alkalinity varied little among ponds (0 to 2.0) with the majority (83 percent) of ponds having alkalinity values between 0 and 1.0. Maximum depths of ponds ranged from 0.5 m to 5.5 m, and 83 percent of the ponds examined had maximum depths of 2.5 m or less (Table 1). Of all water quality measurements taken, water hardness showed the greatest range in values (from 2 to 46). Two ponds that were very acidic (pH=4.0) and hard (34 ppm and 46 ppm, respectively) contained high numbers of amphibians and aquatic organisms. Bennett (1970) reported that the acidity of strip mine ponds was frequently counteracted by extreme water hardness which allowed the survival of fish and other aquatic organisms. Such a chemical interaction may have occurred in the two ponds previously mentioned.

Aquatic Vegetation

Aquatic vegetation greatly enhances the habitat value of permanent ponds by providing both food and cover for many wildlife species. Of eight species of aquatic plants found in the Ollis Creek pond, common cattail (*Typha latifolia*) was the most widespread, occurring in 20 of the 24 ponds (Table 2). Cattail is consumed by muskrats (Arata 1959), geese (Martin et al. 1961) and other wildlife species. Muskrats fed on cattails in at least two of the ponds examined in this study.

Soft-stem bulrush, soft-rush, and spike-rush, which occurred in the Ollis Creek ponds, are important waterfowl food plants (Tarver et al. 1978). Soft-stem bulrush is eaten by white-tailed deer (*Odocoileus virginianus*); spike-rush is utilized by many marsh and songbirds (Tarver et al. 1978). Deer were frequently observed around the Ollis Creek ponds and signs of light browsing on the aquatic vegetation were noted.

In essence, aquatic vegetation forms the base of a complex food web. Rushes and sedges are fed on by many species of insects (Frohne 1938), which, in turn, attract predatory species such as frogs, toads, and birds. Aquatic vegetation also provides roosting and

BLANK PAGE

BLANK PAGE

BLANK PAGE

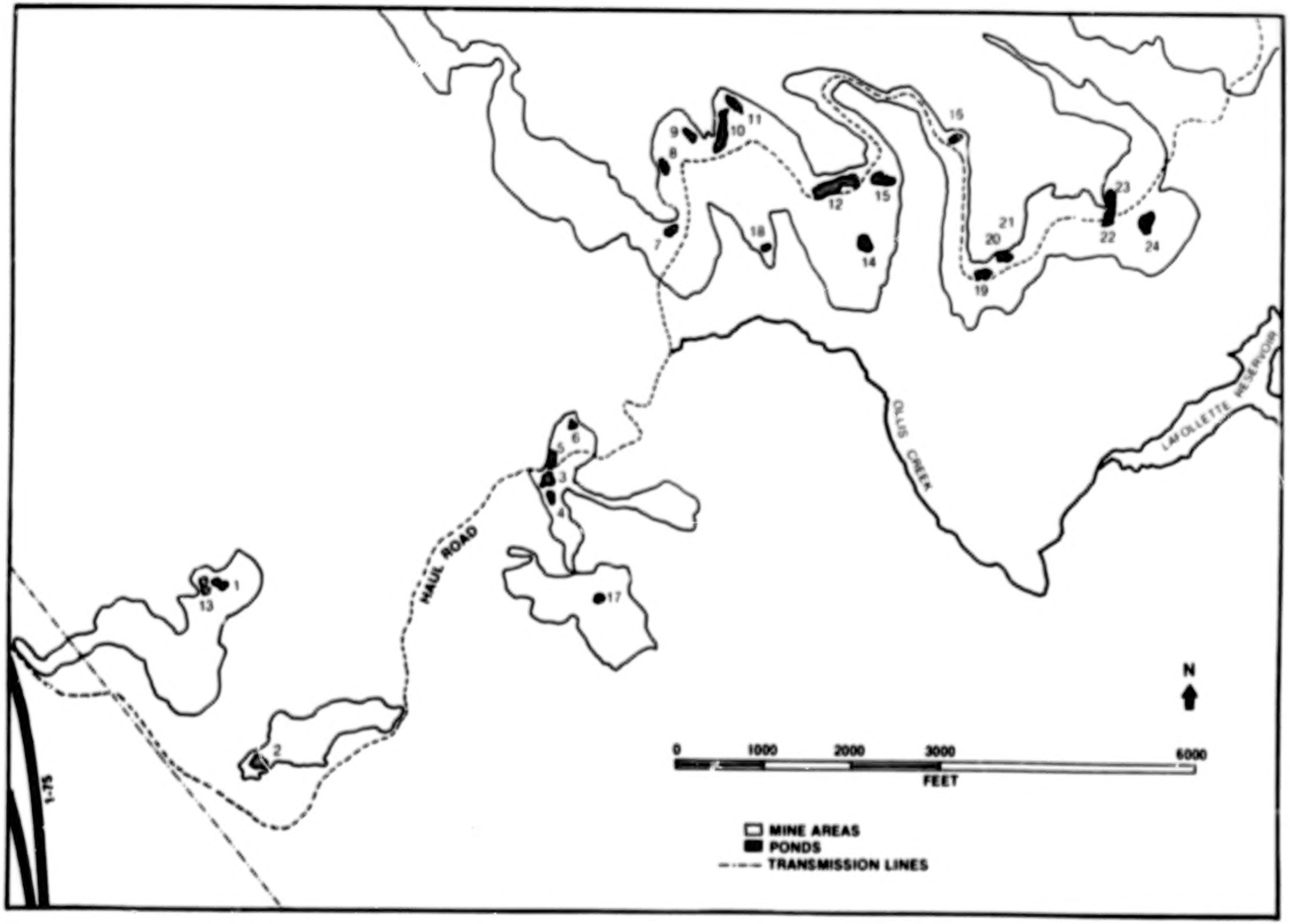

Figure 1. This diagram depicts the location of the 24 Ollis Creek Surface Mine ponds which were surveyed for the presence of breeding amphibians.

Table 1. Water quality measurements and breeding amphibians found in Ollis Creek Surface Mine ponds in 1978.

Water Quality Data						Utilization of Ponds by Breeding Amphibians (X denotes presence)											
Pond No.	pH	Alkalinity	Hardness	Maximum Depth in Meters		Spotted Salamander	*Bufo* Species	N. Cricket Frog	N. Spring Peeper	Gray Treefrog	Upland Chorus Frog	Bullfrog	Green Frog	Pickerel Frog	Wood Frog	Red-Spotted Newt	Total Amphibian Species Pond
1	7.1	1.3	8.1	0.5		X			X	X	X		X	X		X	7
2	4.0	1.0	9.1	0.5					X	X		X	X				4
3	8.0	2.0	8.0	2.5		X	X		X	X	X	X	X	X		X	9
4	5.5	1.0	19.0	2.0					X	X				X			3
5	4.0	1.0	20.0	0.5						X						–	1
6	4.0	0	29.0	0.5					X							–	1
7	4.5	1.0	18.1	0.5					X					X			2
8	4.0	0	34.0	1.5		X	X		X			X		X		X	6
9	4.0	0	6.0	1.5													0
10	4.0	0	13.0	4.5					X								1
11	4.0	2.0	13.0	2.5		X			X							X	3
12	6.0	1.0	15.0	5.0			X		X	X			X				4
13	6.0	1.3	2.3	1.0		X		X	X		X		X	X	X	X	8
14	4.0	0	46.0	1.5		X	X		X		X			X		X	6
15	6.0	1.0	26.0	5.5		X			X	X	X	X	X			X	7
16	4.0	0	7.3	0.5					X								1
17	6.5	1.0	4.0	0.5			X		X		X	X		X	X		6
18	4.0	0	2.0	1.0													0
19	4.0	1.0	4.0	1.5										X			1
20	4.0	0	5.0	1.5													0
21	4.0	1.0	9.0	1.5										X			1
22	6.0	1.0	28.0	1.5			X		X	X	X		X	X			6
23	7.0	1.0	17.0	3.5						X	X	X	X				4
24	7.4	1.0	9.0	2.5		X	X									X	3
Means	5.1	0.8	14.7	1.8													
					Totals[1]	8	7	1	16	9	8	6	8	11	2	8	

---

[1] Total number of ponds utilized by each amphibian species.

nesting cover for waterfowl, marsh wrens, and blackbirds (Martin et al. 1961). Cattails were used as nesting sites by Red-winged Blackbirds (*Agelaius phoenicius*) in eight of the Ollis Creek ponds.

Amphibian Inventory

Twelve of the 17 species of amphibians whose geographic ranges coincided with the Ollis Creek Surface Mine were collected in the study ponds (Table 3). Since no streams or creeks on the site were surveyed, those amphibians that primarily occupy running water were not included in this list. Although a few amphibian species were recorded in ponds with pH values as low as 4.0, significantly more species ($P<0.05$) occurred in the less acidic ponds (Tables 3 & 4). The pond with the highest pH (Pond 3, pH=8.0) contained the highest number of amphibians (nine). The pH effects on specific amphibians are discussed in the following species accounts.

Species Accounts

Hylidae

Spring Peeper—Conant (1975) reports that spring peepers begin calling with the first warm spring rains and sometimes continue well into June. Our study was initiated on March 13, 1978, after spring peepers had already laid large numbers of eggs. On our study area, peak daytime calling occurred in early March and had almost ceased by mid-April, although some scattered calling was heard until mid-May. This species successfully bred in a number of ponds, as evidenced by large numbers of tadpoles and subadults that were seined during May 1978. It was also the most common amphibian recorded, occurring in 16 of the 24 ponds surveyed.

The mean pH value of ponds occupied by spring peepers was 5.22 (Table 3.), the lowest mean pH value recorded for any amphibian species. Peepers laid eggs and called from three very acidic ponds (pH=4.0) that were not inhabited by other amphibians. However, the availability of marginal vegetation for calling sites seemed to be the most critical factor in selection of breeding ponds, since peepers were not recorded in ponds lacking emergent vegetation. Our observations were in agreement with Conant's (1975), who states, "In general, these small singers tend to form their choral group where trees or shrubs are standing in the water, or at least nearby."

Gray Treefrog—This species (Figure 2) was heard calling from nine of the study ponds and adjacent wooded areas in late May. Although the majority of ponds where this treefrog was found (67 percent) had a pH of 6.0 or greater, two very acidic ponds (pH=4.0), which contained standing dead trees and a wooded shoreline, were also used as calling sites. Average pH of ponds used by this frog was 5.96. Our data indicate that it was not a successful breeder on the study area since neither larval nor subadult forms of this frog were found in any of the surface mine ponds.

Upland Chorus Frog—Upland chorus frogs were heard calling from eight of the study ponds from early March to late May 1978 and bred successfully in the

Table 2. Submergent (S) and emergent (E) vegetation collected in Ollis Creek Surface Mine ponds.

Species	Value to Wildlife[1]
(S) Water starwort (*Callitriche heterophylla*)	No information available
(E) Woolgrass (*Scirpus cyperinus*)	Medium
(E) Soft-stem bulrush (*Scirpus Validus*)	High
(E) Spike-rush (*Eleocharis obtusa*)	Medium
(E) Soft rush (*Juncus effusus*)	High
(E) NCN[2] (*Juncus acuminatus*)	No information available
(S) NCN (*Lindernia dubia*)	No information available
(E) Common cattail (*Typha latifolia*)	Medium

[1] Information compiled from Martin et al. (1961) and Tarver et al. (1978).
[2] No common name.

BLANK PAGE

BLANK PAGE

BLANK PAGE

Table 3. Average pH of ponds utilized by breeding amphibians on the Ollis Creek site.

Amphibian Species[1]	Number of Ponds Used	Average[2] Pond pH
Ambystomatidae		
* *Ambystoma maculatum* (spotted salamander)	8	6.32
A. opacum (marbled salamander)	–	–
A. t. tigrinum (eastern tiger salamander)	–	–
Bufonidae		
* *Bufo a. americanus* (American toad)[3]	?	?
* *B. woodhousei fowleri* (Fowler's toad)[3]	?	?
* *Bufo sp.* (American toad and/or Fowler's toad)[3]	7	5.97
Hylidae		
* *Acris c. crepitans* (northern cricket frog)	1	6.00
* *Hyla c. crucifer* (northern spring peeper)	16	5.22
* *H. versicolor* (gray treefrog)	9	5.96
* *Pseudacris triseriata feriarum* (upland chorus frog)	8	6.33
Microhylidae		
Gastrophyne carolinensis (eastern narrow-mouthed toad)	–	–
Pelobatidae		
Scaphiopus h. holbrooki (eastern spadefoot)	–	–
Ranidae		
* *Rana catesbeiana* (bullfrog)	6	5.91
* *R. clamitans melanota* (green frog)	8	6.26
* *R. palustris* (pickerel frog)	11	5.42
* *R. sylvatica* (wood frog)	2	6.25
R. utricularia (southern leopard frog)	–	–
Salamandridae		
* *Notophthalmus v. viridescens* (red-spotted newt)	8	5.80

[1] This list was compiled from Conant (1975) and includes those amphibians with geographic ranges inclusive of our study site.

[2] Calculated by averaging the pH values of surface mine study ponds used by each species.

[3] Adult forms of both American and Fowler's toads were collected on the mine site. However, eggs and larval forms of the two species are very difficult to separate and were simply designated as *Bufo* sp. at the seven ponds where they were collected.

*Recorded on surface mine ponds at the Ollis Creek study site.

Table 4. Average number of amphibian species occurring in surface mine ponds of different pH values, Ollis Creek Mine, March–July 1978.[1]

Average pH	Number of Ponds	Average Number of Amphibians
4.0–5.5	15	1.9
6.0–7.5	8	5.4

[1] Significantly more amphibian species utilized ponds in the pH range of 6.0–7.5 ($P<0.05$).

surface mine ponds as evidenced by large numbers of eggs and tadpoles. The average pH of ponds occupied by upland chorus frogs (6.33) was higher than the average pH of ponds used by the other amphibian species. Only one very acidic pond (pH=4.0) was used as a calling site.

Northern Cricket Frog—Adult forms of this species were not found. They had been present since large numbers of larval forms were collected in one of the ponds (pH=6.0) in mid-May.

Bufonidae

Fowler's Toad and American Toad—Adult forms of both species of toads (Figure 3) were collected on moist land surrounding three of the surface mine ponds. Eggs and larval forms of the two species were very difficult to separate and were simply designated as *Bufo* sp. Toads called from at least one pond in late April, and eggs were found in seven of the study ponds (average pH=5.97). Two very acidic ponds (pH=4.0) contained both eggs and tadpoles. The majority of ponds occupied by *Bufo* sp. had a pH of 6.0 or greater. Barbour (1971) reported that the peak breeding season for the American toad was generally in mid-April, two weeks or more before Fowler's toad begins breeding.

Ranidae

Bullfrog—Bullfrogs occupied six of the study ponds (average pH=5.91). Although two ponds of low pH (pH=4.0) were used by bullfrogs, the majority of ponds had pH values of 6.0 or greater. Barbour (1971) reported that bullfrogs usually begin calling in late April or early May and continue until August or sometimes September. Bullfrog calling on our study area peaked in late May, and large numbers of tadpoles were collected throughout the breeding season.

Green Frog—Green frogs (Figure 4) occupied eight of the study ponds (average pH=6.26), but only one of these ponds had a pH of less than 6.0. Adults of this species were heard calling in June and July. Barbour (1971) reported that green frogs breed from about the middle of May until mid-August and that the tadpoles metamorphose from April to September of the following year. On our study area large numbers of tadpoles were found in April and May 1978. The large size indicated that they had apparently overwintered as tadpoles.

Wood Frog—Although wood frog tadpoles were found in two of the study ponds (with pH values of 6.0 and 6.5) in early May, no adult wood frogs were seen or heard. This may be explained by the observations of Conant (1975), who characterizes the wood frog as "... an explosive breeder, the eggs being laid all in the course of a very few days and the adults then disappearing from the ponds instead of lingering ... ."

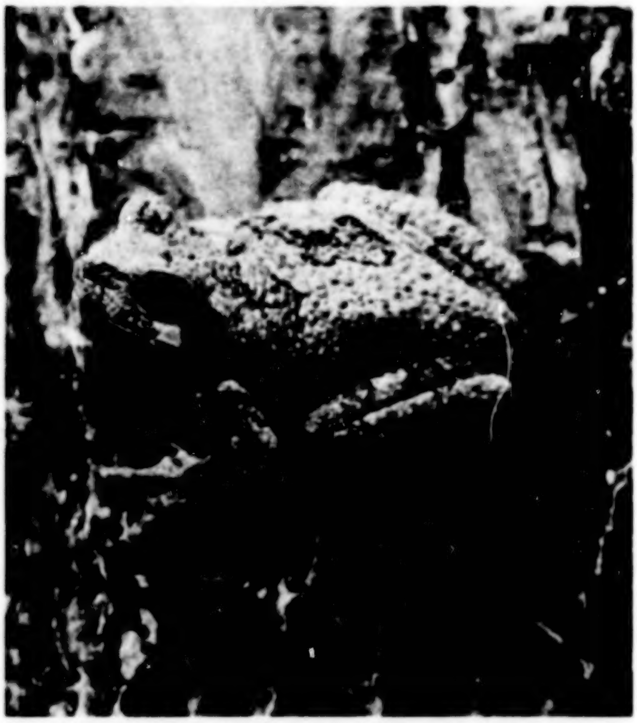

Figure 2. Adult gray treefrogs used nine of the study ponds, predominantly those with thick stands of aquatic vegetation or closely adjacent to woodland areas.

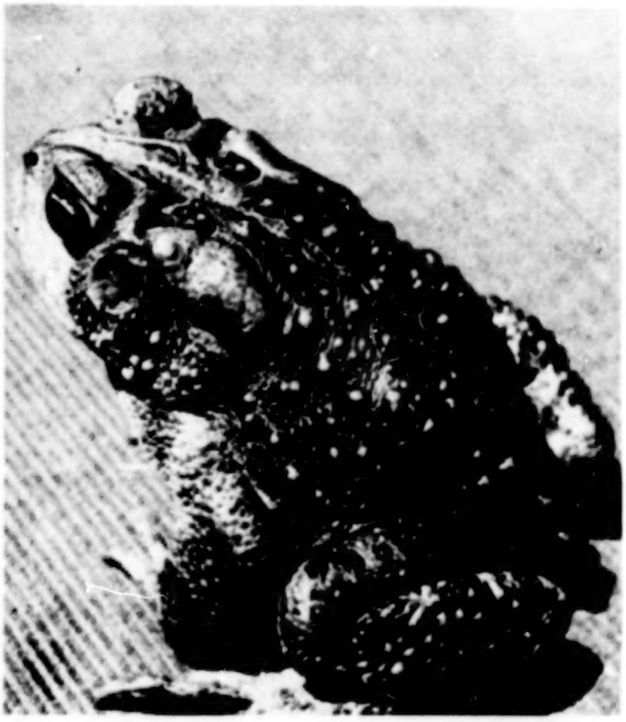

Figure 3. American toads were frequently observed feeding along the moist weedy edges of the surface mine ponds where insects were plentiful. Breeding, calling, and egg laying took place in July.

Figure 4. Green frogs, which were collected in eight of the Ollis Creek ponds, overwintered as tadpoles in the ponds.

Figure 5. The pickerel frog was the second most widespread amphibian on the Ollis Creek site, occuring in 11 of the 24 ponds.

The wood frog breeds very early; the eggs are sometimes laid before ice is off of the ponds (Conant 1975).

Pickerel Frog—The pickerel frog, which breeds from March to May (Conant 1975), was heard calling in our study area from late March to late May (Figure 5). This species was the second most common amphibian, occurring in 11 of the study ponds. Five of these ponds had pH values of 4.5 or less (average pond pH=5.42). The large number of tadpoles and eggs observed suggests that this species is tolerant of low pH levels.

Ambystomatidae

Spotted Salamander—The spotted salamander (Figure 6) is an early spring breeder which migrates to woodland ponds (Conant 1975) at the onset of warm spring rains. Eggs of the spotted salamander were found in five of the study ponds in mid-March (average pH=6.32). Most pH values in these ponds were greater than 6.0, although one pond of pH=4.0 contained eggs of the spotted salamander. No adults or larval forms of the species were found.

Salamandridae

Red-Spotted Newt—Adult red-spotted newts (Figure 7) were found in 8 of the 24 surface mine ponds. Breeding pairs as well as large gravid female newts were observed in our study ponds, but no eggs were found. Adult newts feed, breed, and lay their eggs in water. Eggs then hatch and metamorphose into an eft stage which spends most of its time (1-2 years) on land (Conant 1975). The life cycle is completed when the eft returns to the water, matures, and breeds. Six of the ponds utilized by the newts had pH values of 6.0 or greater while two ponds had pH values of 4.0 (average pH=5.80).

General Wildlife Observations

Seventeen different species of waterbirds were observed around or on the Ollis Creek Surface Mine ponds (Table 5). Although the majority of these birds appeared to be transients, a pair of green herons (*Butorides striatus*) successfully nested in a black locust tree (*Robinia pseudoacacia*) at the periphery of Pond 14. On several occasions, the parent birds were observed feeding ranid frogs to their four young, which fledged from this nest in July 1978.

White-tailed deer, muskrats, and woodchucks (*Marmota monax*) were observed using Ollis Creek ponds for either feeding, watering, or congregating areas. Other researchers have made similar observations. Arata (1959) reported that strip mine ponds in southern Illinois supported fair populations of muskrats. Collins (1956) noted a major movement of deer from a stocked area into reclaimed strip mine lands in western Kentucky. Other wildlife observed in the Ollis Creek ponds were rough green snakes

(*Opheodrys adestivus*) and northern water snakes (*Natrix s. sipedon*).

Implications of Findings

Our findings constitute a strong biological justification for retaining safely constructed sediment ponds as permanent sources of water on surface mined lands. In our study, the presence of 12 species of amphibians, 17 species of waterbirds, and 1 mammalian species on the Ollis Creek Mine can be directly attributed to the sediment ponds which were left by the mine operator after bond release. An Illinois study reported that greater avian diversity on surface mined lands with similar vegetation was usually due to the presence of water (Karr 1968). In addition, many of the Ollis Creek surface mine ponds meet the necessary chemical and physical requirements to support fish population. Since completion of this study, the Ollis Creek ponds have been stocked with bass and bluegill. To date, survival and growth of fish have been good and should provide public recreational opportunities in the near future.

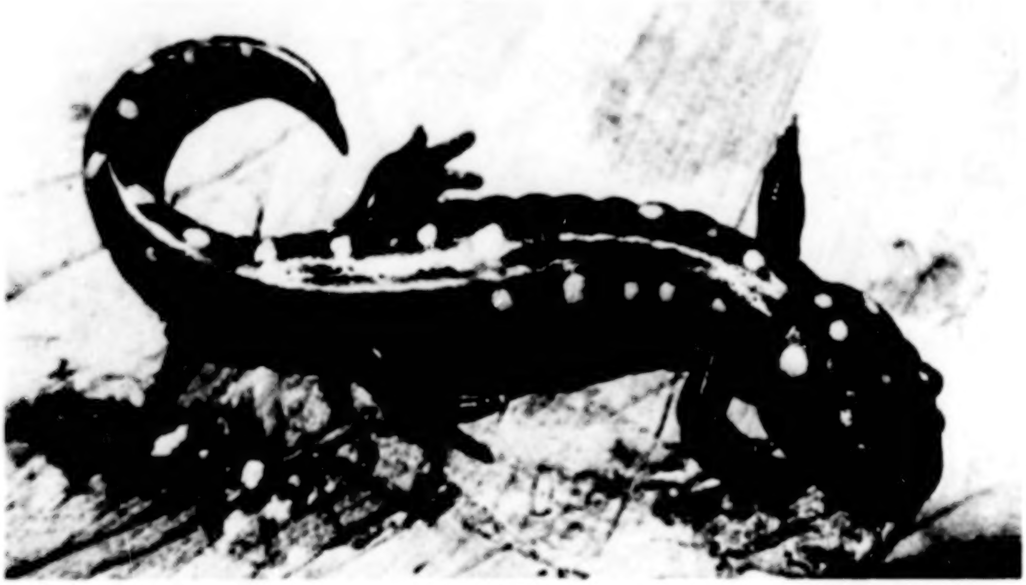

Figure 6. Spotted salamander eggs were found in eight of the surface mine ponds in early spring. It is not surprising that no adult salamanders were found, since they leave the ponds immediately after laying their eggs.

Figure 7. Large numbers of adult red-spotted newts were found in eight of the study ponds. Gravid females, as well as mating pairs, provided some evidence of breeding success.

In view of the thousands of surface mine ponds that have been, and will continue to be, constructed throughout the Appalachian coalfield, it becomes obvious that permanent retention of these small impoundments would have a tremendous *positive* impact on wildlife populations in the region (Figure 8). As stated by Boccardy and Spaulding (1968:19): "Reclaimed strip mine areas have a large potential for fish and wildlife. Restored and revegetated strip mines, combined with impoundments, could provide hunting and fishing opportunities on thousands of acres." It is significant that the pond-associated benefits to wildlife can be achieved at no additional reclamation cost and indeed would save money since the cost of moving men and equipment back to a site to breach and revegetate impounded areas is considerable (Fowler and Turner 1981).

Although the permanent Federal regulatory program provides for the retention of sediment ponds, after bond release (30 CFR Parts 700–890), a streamlined procedure has not yet been formulated by regulatory agencies and few coal operators are making such a request. In addition, it is cheaper and easier for miners to construct the absolute minimum number of water impoundments due to stringent engineering and water quality standards of PL 95–87. These regulations were badly needed, but they may result in a drastic reduction of new permanent surface mine ponds. If such a trend persists, State and Federal wildlife agencies stand to lose significant wildlife habitat benefits (Figure 9).

Wildlife and regulatory agencies need to carefully weigh the biological benefits associated with surface mine impoundments and devise a logical and practical procedure for allowing permanent retention of these sediment basins.

Table 5. Water birds observed on ponds of the Ollis Creek site, Campbell County, Tennessee.[1]

Scientific Name	Common Name
Anatidae	
Branta canadensis	Canada Goose
Aix sponsa	Wood Duck
Anas platyrhynchos	Mallard
Anas rubripes	Black Duck
Aythya affinis	Lesser Scaup
Oxyura jamaicensis	Ruddy Duck
Anas discors	Blue-Winged Teal
Aythya americana	Redhead
Ardeidae	
Ardea herodias	Great Blue Heron
Butorides striatus	Green Heron
Nycticorax nycticorax	Black-crowned Night Heron
Charadriidae	
Actitis macularia	Spotted Sandpiper
Erolia minutilla	Least Sandpiper
Tringa solitaria	Solitary Sandpiper
Parulidae	
Seirus motacilla	Louisiana Water Thrush
Podicipedidae	
Podilymbus podiceps	Pied-billed Grebe
Rallidae	
Fulica americana	American Coot

---

[1] Scientific and common name follow those in the A.O.U. Checklist (1975) and current supplements (1973, 1976).

Figure 8. Sediment ponds, such as this seven-year-old pond on the Ollis Creek Mine, rapidly develop into attractive wildlife habitat. If permanently retained, such impoundments will have a tremendous positive impact on wildlife in the region.

Figure 9. Surface mine ponds can provide recreational opportunities while improving wildlife habitat. Many abandoned mine ponds, such as this eight-year-old Ollis Creek pond can be successfully stocked with fish.

SUMMARY

1. A total of 24 ponds formed by surface mining was examined for the presence of amphibians.

2. Breeding amphibians were observed in 21 of the 24 study ponds.

3. Of 17 pond-breeding amphibian species with geographic ranges encompassing the Ollis Creek site, 12 species were found in the study ponds.

4. Ponds with low pH values were inhabited by breeding amphibians, but those with higher pH values contained significantly more amphibian species.

5. The average pH of ponds occupied by different amphibian species varied. Spring peepers occupied ponds with the lowest average pH (5.22) while upland chorus frogs utilized ponds with the highest average pH (6.33).

6. Aquatic vegetation was found in 20 of the 24 ponds. Cattail was the most common plant, occurring in 20 of the 24 ponds. Those species of aquatic plants found on the surface mine ponds were recognized as being important to a variety of wildlife species for food and cover.

7. A diverse wildlife fauna utilized the surface mine ponds. Large mammals (3 species), waterbirds (17 species), and snakes (2 species) were among those species observed.

8. Some of the ponds examined had the necessary physical and chemical parameters for fish survival and growth and could therefore be stocked.

9. The results of this investigation constitute a strong biological justification for retaining safely constructed sediment ponds as permanent sources of water on coal surface-mined lands.

LITERATURE CITED

American Ornithologists' Union. 1975. Checklist of North American birds. Port City Press Inc., Baltimore. 691 p.

Altig, R. 1970. A key to the tadpoles of the continental United States and Canada. Herpetologica 26(2): 180-207.

Arata, A. A. 1959. Ecology of muskrats in strip mine ponds in southern Illinois. J. Wildl. Manage. 23(2): 177-186.

Barbour, R.W. 1971. Amphibians and reptiles of Kentucky. University Press of Kentucky, Lexington. 334 p.

Bennett, G. W. 1970. Management of lakes and ponds. Van Nostrand Reinhold Co., New York. 375 p.

Boccardy, J. A., and W. M. Spaulding, Jr. 1968. Effects of surface mining on fish and wildlife in Appalachia. Bureau of Sport Fisheries and Wildlife Resource Publication 65. 20 p.

Braun, E. L. 1950. Deciduous forests of Eastern North America. Hafner Press. New York. 596 p.

Collins, F. W. 1956. Game management practices on strip mined land. Proc. S.E. Assoc. Fish Game Comm. 10: 213-220.

Conant, R. 1975. A field guide to reptiles and amphibians. Houghton-Mifflin Co., Boston. 429 p.

Fowler, D.K. and L.J. Turner. 1981. Surface mine reclamation for wildlife, a model reclamation plan for southern Appalachia. Eastern Energy and Land Use Team, U.S. FWS. FWS/OBS-81/09.

Frohne, W. C. 1938. Contribution to knowledge of the limnological role of the higher aquatic plants. Trans. Amer. Micr. Soc. 57: 257-268.

Karr, J. R. 1968. Habitat and avian diversity on strip mined land in east-central Illinois. Condor 70(4): 348-357.

Martin, A. C., H. S. Zim, and A. L. Nelson. 1961. American wildlife and plants a guide to wildlife food habits. Dover Publications, Inc., New York, 500 p.

McAtee, W. L. 1939. Wildfowl food plants. Collegiate Press, Inc., Ames, Iowa. 141 p.

Myers, C. W., and W. D. Klimstra. 1963. Amphibians and reptiles of an ecologically disturbed area in southern Illinois. Amer. Midl. Nat. 70(1): 126-132.

Orton, G. L. 1952. Key to the genera of tadpoles in the United States and Canada. Amer. Midl. Nat. 47(2): 382-394.

Public Law 95-87. August 3, 1977. Surface mining control and reclamation of 1977. 30 USC 1201 Note.

Radford, A. E., H. E. Ahles, and C. R. Bell. 1968. Manual of the vascular flora of the Carolinas. University of North Carolina Press, Chapel Hill. 1183 p.

Riley, C. V. 1970. The ecology of water areas associated with coal strip-mined lands in Ohio. Ohio J. Sci. 60(2): 106-119.

Ripley, T. H. 1969. Planning wildlife management investigations and projects, pages 5-12 *in* Wildlife management techniques, 3rd ed. The Wildlife Society Inc., Washington, DC. 623 p.

Smith, B. M., and E. P. Hill. 1978. The potential of coal strip mines in Alabama as waterfowl habitat. Unpubl. final report to Tennessee Valley Authority. Auburn Univ., Alabama Cooperative Wildlife Research Unit. 22 p.

Steel, R.G.D., and J. H. Torrie. 1960. Principles and procedures of statistics. McGraw-Hill Publishing Co., New York. 481 p.

Tarver, D. P., J. A. Rodgers, M. J. Mabler, and R. L. Lazor. 1978. Aquatic and wetland plants of Florida. Bureau of Aquatic Plant Research and Control. Florida Department of Natural Resources. 127 p.

50272 -101

REPORT DOCUMENTATION PAGE	1. REPORT NO. FWS/OBS-81/08	2.	3. Recipient's Accession No.

4. Title and Subtitle
Utilization of Surface Mine Ponds in East Tennessee by Breeding Amphibians

5. Report Date
June 1981

6.

7. Author(s)
Linda J. Turner and Dale K. Fowler

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Division of Land and Forest Resources
Office of Natural Resources
Tennessee Valley Authority
Norris, Tennessee 37828

10. Project/Task/Work Unit No.
Coal/D.10

11. Contract(C) or Grant(G) No.
(C) 14-16-0009-78-908
(G)

12. Sponsoring Organization Name and Address
Eastern Energy and Land Use Team
Fish and Wildlife Service
U.S. Department of the Interior
Kearneysville, West Virginia 25430

13. Type of Report & Period Covered
Final

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

Breeding amphibians were found in 21 of 24 ponds examined on the Ollis Creek Surface Mine in Campbell County, Tennessee. Twelve species of amphibians were identified in ponds that range from 4.0 to 8.0 in pH. Although ponds with low pH values were used by breeding amphibians, significantly more amphibian species were found in ponds with higher pH values.

Findings indicated high biological productivity in the surface mine ponds examined. Aquatic vegetation was present in 20 of the 24 ponds. Aquatic insects and a diverse wildlife fauna utilized the study ponds.

Surface mine ponds were found to supply an important habitat component for a variety of wildlife species and therefore improve the quality of wildlife habitat on the surface mines.

17. Document Analysis a. Descriptors
Amphibians, Surface Mining, Coal Mining, Mine waters, Ponds, Breeding

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group 6C, 48B

18. Availability Statement Release Unlimited	19. Security Class (This Report) Unclassified	21. No. of Pages 20
	20. Security Class (This Page) Unclassified	22. Price

(See ANSI-Z39.18)

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

BEST DOCUMENT AVAILABLE

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF THE INTERIOR
INT-417

END

5-9-83